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REMARKS

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Reconsideration of this application is respectfully requested.

Claims 6-7, 14-15, 24-25, and 35-36 are canceled without prejudice. Claims 1-5, 8-13, 16-23, 26-34, and 37 are currently pending in the application. Claims 1, 11, 12, 20, 26, 31 and 37 have been amended and no new matter has been added. The support of the amendment can be found on page 5 and Figures 4-5 of the application.

Attached is a marked up version of the amendments made to the claims by the present reply. The attached page is entitled "Version with Markings to Show Changes Made."

Objection on Priority

The Examiner objected to the priority statement in the specification, which does not match with the record in the Office. Applicants have concurrently filed a Request for Issuance of Corrected Filing Receipt and a copy of the Request and related supporting papers are enclosed for your review. Consequently, this objection is traversed.

Oath/Declaration

The Examiner also requested a new Declaration with the filing date of June 20, 2000 for the Provisional Application No. 60/212,552. As indicated above, since the recorded filing date for the Provisional Application in the Patent Office is incorrect, Applicants believe that the new declaration is not necessary at this time.

Objection to Specification

The Examiner further objected to the informality of the "range from 0 to 1" on page 6, line 17 of the specification. This informality has been corrected. As such, this objection is traversed.

Claim Rejections under 35 USC §112

The Examiner rejected Claims 2, 4, 8, and 11-37 under 35 USC §112 as being indefinite for failing to particularly point out and distinctly claim the subject which applicant regards as the invention. Specifically, the Examiner indicated that the term "substantially" in Claims 2, 4, 8, 11, 13, 16, 23, 32, 34, and 37 is indefinite because the term has not been defined.

Applicants respectfully contend that it is not necessary to define the term "substantially" because it is definite. The Federal Circuit has ruled that " "substantially" means considerable in ... extent," or "largely but not wholly that which is specified." *York Products, Inc., v. Central Tractor Farm & Family Center*, 99 F.3d 1568, (Fed Cir, 1996). Accordingly, Applicants submit that the term "substantially" is definite and the definition of this term is not required.

Furthermore, the Examiner also rejected Claims 12, 20, 26, and 37 under 35 USC §112 as indefinite and/or insufficient antecedent basis. Claims 12, 20, 26, and 37 have been amended in accordance with the Examiner's suggestion. Accordingly, Applicants respectfully submit that the rejections under section 112 are overcome.

Claim Rejections under 35 USC § 102

The Examiner rejected Claims 1-6, 8, 11-14, 16, 19-24, 27, 31-35, and 37 under 35 USC § 102(e) as being anticipated by Ermer et al. (U.S. Pat. No. 6,380,601), hereinafter called "Ermer". Applicants agree with the Examiner's finding that Ermer does not disclose the use of arsenic as the n-type dopant, as recited in Claims 7, 15, 25, and 36. See page 6 of the Office Action. Accordingly, Claims 7, 15, 25, and 36 have been incorporated into Claims 1, 11, 20, and 31, respectively. For at least this reason, Claims 1, 11, 20, and 31 should be allowable over Ermer under section 102. Since Claims 2-5, 8, 12-13, 16, 19, 21-

23, 27, 32-34, and 37 depend from Claim 1, 11, 20, and 31, Claims 2-5, 8, 12-13, 16, 19, 21-23, 27, 32-34, and 37 should also be patentable over Ermer under section 102. Therefore, Applicants submit that Ermer can not anticipate Claims 1-5, 8, 11-13, 16, 19-23, 27, 31-34, and 37 as amended of the present application under section 102.

Claim Rejections under 35 USC § 103

The Examiner further rejected Claims 7, 9, 10, 15, 17-18, 25-26, and 36 under 35 USC § 103 as being unpatentable over Ermer. Claims 1, 11, 20, and 31 have been amended to more specifically reflect the claimed invention. Applicants respectively submit that the presently claimed invention is patentable over Ermer under § 103.

The present invention discloses a germanium substrate doped with at least two types of n-type dopants. Claim 1 recites in part:

> a first cell layer comprising a germanium (Ge) substrate doped with an n-type dopant, wherein the n-type dopants in the germanium substrate includes phosphorus and arsenic.

(Emphasis added). In other words, the present invention discloses a p-type substrate such as a germanium substrate, doped with two types of n-type dopants such as phosphorus and arsenic. The feature of having two types of n-type dopants in a germanium substrate was never taught or suggested by Ermer. In contrary to the present invention, Ermer particularly states that "the germanium substrate comprises two regions, a bulk germanium region, and a phosphorus-doped germanium region." See column 2, lines 6-8 of Ermer.

To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Since Ermer does not teach or suggest a germanium substrate doped with

two types of n-type dopants, Claims 7, 9, 10, 15, 17-18, 25-26, and 36 should be patentable over Ermer under 35 USC § 103.

The Examiner further rejected Claims 9, 17, and 26 under 35 USC § 103 as being unpatentable over Ermer in view of Stanbery (U.S. Pat. No. 4,322,571), hereinafter called "Stanbery". Also, Claims 28-30 are rejected under § 103 as being unpatentable over Ermer in view of Gibbons (U.S. Pat. No. 4,001,864), hereinafter called "Gibbons". Since Claims 9, 17, 26, 28-30 depend from Claims 1, 11, 20, Claims 9, 17, 26, 28-30 should be patentable because Claims 1, 11, 20 are in condition for allowance as discussed earlier. Federal Circuit has ruled that if independent claims are valid, the claims that depend from the independent claims should also be valid as matter of law. See *Jenric/Pentron, inc. v. Dillon Co.,* 205 F.3d 1377, 1382 (Fed. Cir. 2000).

Consequently, Claims 9, 10, 17-18, 26, and 28-30 are patentable over Ermer in light of Stanbery or Gibbons under 35 USC § 103

CONCLUSION

Based on all of the above, Applicants believe all claims now pending in the present application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

A petition for extension of time for two (2) months is enclosed. No other fees are believed to be due at this time. However, in the event that any further fees are required for this extension or any other matter concerning this response, then such fees are hereby authorized to be charged to White & Case LLP Deposit Account 23-1703.

Applicants thank the Examiner for carefully examining the present application and if a telephone conference would facilitate the prosecution of this application, the Examiner is invited to contact Jim Wu at (650)213-0300.

Respectfully submitted,

Dated: October 16, 2002

By: _____

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Attach

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

I. IN THE SPECIFICATIONS

The specification has been amended as follows:

On page 6, line 17:

The composition of the **[indium gallium]** $\underline{\text{indium}_X\ \text{gallium}_{(1-X)}}$ phosphide (InGaP) nucleation layer is used, where X can range from 0 to 1.

II. IN THE CLAIMS

Please cancel Claims 6-7, 14-15, 24-25, and 35-36 without prejudice. Claims 1, 11, 12, 20, 26, 31 and 37 have been amended as follows.

1. (Amended) A triple-junction solar cell comprising:

a first cell layer comprising a germanium (Ge) substrate doped with an n-type dopant, wherein the n-type dopants in the germanium substrate includes phosphorus and arsenic;

a nucleation layer disposed over the first cell layer;

a second cell layer comprising gallium arsenide (GaAs) disposed over the nucleation layer; and

a third fourth cell layer comprising indium gallium phosphide (InGaP) disposed over the second cell layer.

11. (Amended) A triple-junction solar cell comprising:

a dual-junction structure comprising a first junction and a second junction;

a third junction having a p-type substrate, wherein the third junction doped with arsenic and phosphorus; and

a nucleation layer disposed between the dual-junction structure and the third junction and comprising a material that shares a substantially similar lattice parameter with the p-type substrate of the third junction, wherein the nucleation layer serves to control the diffusion depth of the third junction.

12. (Amended) The triple-junction solar cell as recited in Claim 11 wherein the p-type substrate of the third junction is germanium (Ge) and the nucleation layer comprises indium gallium **[arsenide]** phosphide (InGaP).

20. (Amended) A method for controlling the diffusion of a dopant into a substrate during a subsequent device process during the fabrication of a multi-layer semiconductor structure, the method comprising **[the steps of]**:

(a) disposing a nucleation layer over the substrate;

(b) performing the subsequent device process to form an overlying device layer containing the dopant, wherein the dopants include phosphorus and arsenic, wherein the nucleation layer serves as a diffusion barrier to the dopant in the overlying device layer such that diffusion of the dopant into the substrate **[can be]** is limited by increasing the thickness of the nucleation layer.

26. (Amended) The method as recited in Claim **[19]** 20 wherein a two-step diffusion profile **[can be]** is achieved in an n-p junction formed in the substrate.

31. (Amended) A method for fabricating a multi-layer semiconductor structure, the method comprising **[the steps of]**:

(a) preparing a germanium (Ge) substrate layer for doping by a dopant, wherein the dopants include phosphorus and arsenic;

(b) disposing a nucleation layer over the germanium substrate layer;

(c) disposing a middle layer comprising gallium arsenide (GaAs) over the nucleation layer; and

(d) disposing a top layer comprising indium gallium phosphide (InGaP) over the second tunnel junction, wherein the nucleation layer serves as a diffusion barrier such that diffusion of the dopant into the germanium substrate can be limited by increasing the thickness of the nucleation layer.

37. (Amended) The method as recited in Claim 31wherein **[the]** a junction depth in the **[first cell]** germanium substrate layer is substantially between 0.3 μm and 0.7 μm upon completion of said steps (a) through **[(d)]** (g).